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Conference Report, Space and Scatter Symposium

1. On 6 and 7 October 1958, the writer attended the National Symposium on Extended Range and Space Communications sponsored by the IRE Professional Groups on Antennas and Propagation and Communications Systems, in cooperation with George Washington University. The lectures were held in Lisner Auditorium on the George Washington University campus. The symposium consisted of a series of papers presented by engineers from Government and industry and covered each of four topics:

a. Space Vehicle Communications
b. Meteoric Scatter Systems
c. Tropospheric Scatter Systems
d. Ionospheric Scatter Systems

2. Space Communications Papers - Mr. Charles P. Scott of Ramo-Wooldridge in a paper entitled "Space Vehicle Television" described a system for receiving television information from a satellite. A space vehicle capable of televising to earth would be used for military surveillance, mapping, and weather forecasting, as well as for astronomical and ultra-violet measurements. Because a "live" television link would be wasteful of bandwidth and power, both of which are at a premium, Mr. Scott suggests using facsimile to transmit photograph information back to earth from a rocket or satellite. In order to conserve power and avoid message gaps, the bullet-shaped vehicle transmits only when its antenna faces the earth, as determined by photoelectric cells. Various techniques to reduce wobble and translate all lateral motion into axial spin were described.

Mr. Donald MacLelland of Lincoln Laboratories discussed the use of satellites as passive reflectors for long-range communications. A 160-foot diameter balloon inflated sphere 400 miles high would reflect signals from a 200 kw ground transmitter over an area of about 1,000 miles and would circle the earth in about 100 minutes. Theoretically about 2 dozen spheres would be needed for full-time contact between any two stations, but the number would be much higher in practice due to the high precession of large low density objects. This problem and the mechanical difficulties in tracking large antennas favor the use of synchronized satellites about 23,000 miles high which remain fixed above one spot on the earth's surface.

Eight such satellites in equatorial orbits could reflect signals over the earth's surface between 60°N and 60°S latitude. At such a height, however, the energy reflected from a small satellite is limited and the principal advantage becomes the ability to use a non-tracking (but by no means fixed) antenna array.

In a long and highly theoretically presentation, Mr. Sol Perlman of the Army Signal Propagation Lab discussed the factors which affect the choice of frequency for space vehicle communications. His conclusion was that frequencies in the range of 2 to 10 kmc represented the best compromise for the forseeable future.

3. Meteoric Scatter - Mr. Wilbur R. Vincent of Stanford Research Institute delivered an invited paper on the status of meteor burst communications. This paper was based on the historic Stanford-Bozeman, Montana tests and is rapidly becoming a standard for communications symposia, the writer having heard it three times in the last year. The latest addition is that observation has shown that the meteor reflection path changes throughout the day, alternating between 20° to the left and 20° to the right of the great circle path. An average information rate of 8 to 15 wpm was reported by Mr. Vincent, with an instantaneous rate of 800 wpm. (Mr. Vincent later told the writer in private that this information rate was lower than the JANET rate reported variously as 26 and 60 wpm because SRI had discounted all non-meteoric reflections in its computations, and said that the JANET figures included sporadic-E and ionospheric reflections.)

Mr. G. W. Davis of Ferranti-Packard, Ltd., Toronto, described the development of the JANET equipment now in use in Canada and Europe. His company is currently working on an error detecting system on a 7-unit code in which every letter has three marks and four spaces. If more or less than 3 marks are received at any time, an error is indicated, and if more than a certain number of errors occur, the receiver automatically signals the transmitter to repeat previous bursts in part or completely.

Mr. George Sugar of NBS described measurements of the extent of multipath distortion in meteoric scatter systems. The average multipath delay was found to be 100 microseconds, although in tests with 10 microsecond bauds (100,000 bits per second) half of the transmissions contained no errors whatever.

4. Tropospheric Scatter - Dr. Nels H. Knudtzon of SHAPE described a 600-mile 3-hop tropospheric scatter link now in operation in Norway. A 36-channel system is operated on parallel 1,000 and 2,000 megacycles links.

Mr. Kenneth P. Stiles of AT&T described a recently designed tropo link between Florida City, Florida, and Nassau, Bahamas. Ten-kilowatt transmitters are used on 2,000 megacycles for a 60-channel system. The link is similar to a very satisfactory circuit (which operates on 800 megacycles) set up three years ago between Havana and Miami.

5. Ionospheric Scatter - Due to other commitments the writer was unable to attend the ionospheric papers presented Tuesday afternoon. The symposium program which is attached summarizes the papers given in this session.

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cc: R+D Subject File
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